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Allelopathic potancial of *Ziziphora clinopodioides* on germination indices and initial growth of *Sinapis arvensis* and *Avena fatua*

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Introduction: Weeds are a serious threat to crop production because they interfere with the crop growth and development and result in significant crop losses. Weeds actually cause yield loss higher than any other pest in crop production. As a result, chemical synthetic herbicides have been widely used for weed management. Heavy usage of chemical synthetic herbicides, however, has resulted in public concerns over the impact of herbicides on human health and the environment (Xuan, et al. 2004). Therefore, unconventional weed control strategies, especially those based on ecological principles, are very much needed in modern agriculture. Allelopathy is considered a multi-dimensional phenomenon occurring constantly in natural and anthropogenic ecosystems, by which one organism produces bio-chemicals that influence the growth, survival, development, and reproduction of other organisms (Rice, 1984).

Materials and methods: In order to study the allelopathic potential of *Ziziphora clinopodioides* on seed germination and seedling growth of *Sinapis arvensis* and *Avena fatua* in laboratory condition, an experiment based on completely randomized design with four replications was carried out. The experimental treatments including distilled water as control, aqueous extract concentrations of *Z. clinopodioides* 10 and 20% (w/v) were used. Twenty g of the powdered organ was placed in a 2 L Erlenmeyer flask and 1L deionized water was added. Flask was covered with aluminum foil to protect photo decomposition and placed on a rotary shaker (~200 revolutions per min.) for 24 h. The mixtures were filtered through Whatman No.1 filter paper using a vacuum pump. The pH and electrical conductivity (EC) of extracts were checked within the tolerance range of target plants. Data were transformed using arcsine prior to statistical analysis if needed. The data for all measured parameters were analysed using the analysis of variance procedure of Statistical Analysis System (SAS), version 9.1. Means were compared by Duncan's multiple range test at the 0.01 probability level for all comparisons.

Results and Discussion: The low concentration (10%) of aqueous extract of *Z. clinopodioides* inhibited the germination of *S.arvensis* and *A.fatua* by 23.3% and 30.4%, respectively. However, the highest concentration (20%) of *Z. clinopodioides* inhibited the germination of *S.arvensis* and *A.fatua* by 65.1 and 74.2%, respectively than control (Table 1). The seedlings growth of *S.arvensis* and *A.fatua* were severely inhibited at the higher concentration (20%) of *Z. clinopodioides* extract. The low (10%) and high (20%) concentrations of *Z. clinopodioides* extract, decreased the seedling length of *S.arvensis* by 36.1% and 64.1%, and the seedling length of *A.fatua* by 47.2% and 74.5%, respectively, than control (Table 1). However, the root length of *S.arvensis* decreased by 42.3% and 75.5%, and the root length of *A.fatua* decreased by 45% and 80.7%, respectively, than control. The effects of allelopathy on germination and growth of plants may occur through various mechanisms such as reduced mitotic activity in roots and hypocotyls, suppressed hormone activity, reduced rate of nutrients uptake, reduction in permeability of cell membranes and inhibition of enzyme action (Rice, 1984).

Conclusion: The results of this experiment showed that the aqueous extract of *Z. clinopodioides* inhibited the germination and seedlings growth of both weeds due to its phytotoxic effects. However, further studies are necessary to find out the mechanism involved in its specific recognition ability.

Keywords: Phytotoxicity, Seed Germination, Weed Control

References

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S.arvensis	**Germination percentage**	**Inhibition percentage (%)**	Germination rate	Inhibition percentage (%)	Average germination duration	Increase percentage (%)	Seedling length (mm)	Inhibition percentage (%)	Seed vigor index	Inhibition percentage (%)
Control	94.8[a]	-	9.34[a]		3.08[c]	-	94.90[a]	-	90.0[a]	-
10%	72.9[b]	23.3	7.48[ab]	19.91	4.94[b]	60.4	60.63[b]	36.1	44.2[b]	50.9
20%	33.2[c]	65.1	5.63[b]	39.72	6.44[a]	109.1	34.13[c]	64.1	11.3[c]	87.4
A. fatua										
Control	96[a]	-	8.28[a]	-	3.37[c]	-	96.90[a]	-	93.0[a]	-
10%	66.8[b]	30.4	4.80[b]	42.03	5.02[b]	49.0	51.13[b]	47.2	34.2[b]	63.2
20%	25.1[c]	74.2	3.51[c]	57.60	6.22[a]	84.6	24.73[c]	74.5	6.2[c]	93.3